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10/083,613	02/26/2002	David F. Bliss	AFB00614	3162

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EXAMINER

SONG, MATTHEW J

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 07/08/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/083,613

Applicant(s)

BLISS ET AL

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 May 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 15-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-14 in Paper No. 5 is acknowledged. The traversal is on the ground(s) that the claims are so closely reacted as to justify examination as a single invention. This is not found persuasive because a serious burden exists in the differing issues likely to arise during the prosecution of the different statutory classes of the invention.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-8 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2).

Vaudo et al teaches a method of forming a (gallium, aluminum, indium) nitride base layer on a substrate by halide vapor phase epitaxy (HVPE), note entire reference. Vaudo et al also teaches in the HVPE process, HCl is passed over a source of high purity gallium to form GaCl, which is transported to a deposition zone where it reacts with ammonia to form GaN (col 10, ln 15-67). Vaudo et al also teaches subatmospheric pressure conditions, 50 Torr, employed during

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growth and further reductions in growth pressure are expected to improve uniformity across the wafer and across multiple wafers within one growth run (col 12, ln 25-40). Vaudo et al also teaches a vessel 64 of molten indium, a vessel 69 of molten gallium and a vessel 67 of molten aluminum (col 11, ln 1-40).

Vaudo et al does not teach contacting a heated metal with iodine vapor.

In a method of growing III-V nitride semiconductors, note entire reference, Hirota et al teaches a forming GaN by reacting HCl with Ga in a container to form GaCl and reacting the GaCl with nitrogen plasma to form a GaN layer 20 ([0055]). Hirota et al also teaches iodine (I₂) may be introduced as a halogen molecule instead of HCl ([0058]). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al with Hirota et al's iodine vapor instead of HCl because substitution of known equivalents for the same purpose is held to be obvious. (MPEP 2144.06).

Referring to claim 2-4, the combination of Vaudo et al and Hirota et al teaches subatmospheric pressures. Vaudo et al does not teach the claimed range of pressure. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 5, the combination of Vaudo et al and Hirota et al teaches Ga, Al and In.

Referring to claim 6, the combination of Vaudo et al and Hirota et al teaches (Ga, Al, In)N.

Referring to claim 7, the combination of Vaudo et al and Hirota et al teach the MI is formed in one locale and then is flowed to another locale to react with ammonia to form MN ('581 Fig 2).

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Referring to claim 8, the combination of Vaudo et al and Hirota et al teach deposition on a substrate 56.

Referring to claims 13-14, the combination of Vaudo et al and Hirota et al teach the same reactants and products as applicant, therefore the reaction chemistry is inherently the same as claimed.

4. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2) as applied to claims 1-8 and 13-14 above, and further in view of Jain (US 4,910,163).

The combination of Vaudo et al and Hirota et al teach all of the limitations of claim 9, as discussed previously, except iodine is placed in a first boat upstream in an elongated first container below an inlet for H₂.

Jain teaches a chemical vapor deposition apparatus, where a continuous tubular reactor is divided into three zones. Jain also teaches in the first zone an iodine boat contains iodine crystals and a resistance heater to elevate the temperature so that iodine is vaporized and admixes with a carrier gas of hydrogen, in the center of the reactor is packed with silicon and in the last zone contains a substrate (col 2, ln 20 to col 3, ln 67). Jain also teaches the iodine and carrier gas passes through the silicon and the iodine reacts with silicon to produce silicon diiodide, which then exits as a part of the gas stream and the silicon diiodide is disproportionated and silicon is deposited on a substrate (col 1, ln 50-67). Jain also teaches the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing (col 1, ln 1-45 and col 4, ln 1-25). It would have been obvious to a person of ordinary

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skill in the art at the time of the invention to modify the combination of Vaudo et al and Hirota et al with Jain's apparatus with iodine in first boat upstream because the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing, thereby increasing productivity.

Response to Arguments

5. Applicant's arguments with respect to claims 1-14 have been considered but are moot in view of the new ground(s) of rejection.

6. Applicant's arguments filed 5/7/2003 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The Jain reference is provided solely as a teaching of forming an Iodine vapor below an inlet for H₂. The two step process for forming metal nitride is taught by the combination of Vaudo et al and Hirota et al.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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Shimoyama et al (US 5,868,834) teaches a vapor phase epitaxy process, where there is no particular restriction on the halide gas or halogen gas, for example, HI or I₂ can be used (col 2, ln 1-67).

Shimoyama et al (US 5,827,365) teaches HI and I₂ are equivalents for manufacturing III-V semiconductors (col 2, ln 30-40 and col 3, ln 1-20).

Steele (US 4,279,670) teaches a container 110 for producing iodide vapor and the iodide vapor is passed through zinc arsenide to form a reactive substance, which deposits on a gallium arsenide substrate (col 4, ln 40-60 and col 7, ln 1-67).

Moon et al (US 3,856,585) teaches a hydrogen halide is used as a transporting gas and is passed over a III-V source material and deposition takes place on a substrate (abstract).

Vaudo et al (US 2002/0166502) teaches a (Ga,Al,In)N deposition using HVPE involving the reaction of HCl and ammonia at pressure of from about 10-800 Torr ([0048]-[0053]).

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS
June 30, 2003


BENJAMIN L. UTECH
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